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The Effect Of AUREOMYCIN Upon the Growth of Dairy Cows When Administered Orally, Subcutaneously And Intramuscularly

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CONTENTS

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It has been shown that the growth rate of dairy calves is increased by the oral administration of small amounts of aureomycin (1, 2, 3, 5, 6, 7, 8, 9, 10, 11, 13 14, 15, 18).* Previous work at this Station (9) indicated that 70 mg. of aureomycin per day in a single oral dose was effective in stimulating the growth rate of calves as measured by bodyweight during the first five weeks of life.

While it has been shown that oral administration of this antibiotic stimulates growth, there is a question as to whether or not aureomycin might stimulate growth when given parenterally. Results of contemporary investigations by Rusoff and associates (16) show that weekly intramuscular injections of 400 mg. of aureomycin were effective in increasing the bodyweight gains of young dairy calves. Results of work by Noland, *et al.* (12) indicate that the subcutaneous implantation of bacitracin pellets produced increased bodyweight gains in young pigs. Terrill, *et al.* (17), however, concluded that the weaning weights of pigs or the survival of pigs to weaning age were not increased by the subcutaneous implantation of either bacitracin, penicillin or aureomycin pellets.

The purpose of this trial was to study the effects of different levels of aureomycin upon the growth rate of dairy calves when given orally, subcutaneously and intramuscularly.

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* Numbers in parentheses refer to Literature Cited, page 10.

Experimental Procedure

Sixty male and female calves of three breeds (Guernsey, Aryshire and Holstein) were used in two experiments. All calves were removed from their dams 48 hours after birth and placed in individual tie-stalls for the duration of the 4-weeks trial.

The temperature of the barn in which the calves were housed was thermostatically controlled at approximately 65° F. during the fall and winter when Experiment I was in progress. Experiment II was conducted during the spring and summer, and the temperature of the barn during this period ranged from 80° to 85° F.

The calves were allotted to experimental groups in which the initial bodyweight and number of calves of each breed were kept as nearly constant as possible. All calves were fed a ration which consisted of one pound of Holstein herd milk per 12.5 lbs. bodyweight daily, good quality prairie hay, and a 16 percent protein calf starter offered *ad lib.*

In the first of the two experiments, five groups of seven calves each were treated as follows:

Group A calves served as untreated controls.

Calves in Group B were given a capsule containing 250 mg. crystalline aureomycin hydrochloride once weekly *per os.*

Calves in Group C received a weekly subcutaneous implantation of 60 mg. aureomycin hydrochloride pellets at the base of the ear by the use of a stilbestrol implant gun. This appeared to be the most reasonable dosage for a single implantation for the purpose of this study. Sixty mg. aureomycin administered weekly by implant as compared to 250 mg. given orally is a 1 to 4 ratio of parenteral to oral administration. Results of studies by Dowling, *et al.* (4) with humans indicated that this dosage ratio should result in comparable blood levels.

Calves in Group D were given a capsule of 70 mg. of crystalline aureomycin hydrochloride *per os* daily and were used as a reference group in order to have a comparison between the present study and previous work.

In Group E, the calves were injected intramuscularly with 60 mg. aureomycin (aureomycin—AlCl complex dispersed in sesame oil) weekly for comparison with the implanted group.

After studies had been completed with 35 calves, a second experiment of similar design was conducted to study the effect of other levels of administration. This experiment involved five groups of five calves each. Groups A and D were continued as in Experiment I to serve as a control and a reference group, respectively. Group F was added to study the effect of a higher level of aureomycin (500 mg.) in a single weekly oral dose. In order to determine whether or not calves would respond to even lower amounts of aureomycin, Group H was included in which calves received 125 mg. weekly in a single oral dose. Group G was added to study a higher level of intramuscular injection. The calves in this group were injected once weekly with 250 mg. of aureomycin.

The effects of the treatments in both 4-weeks experiments were measured by weekly gains in bodyweight, changes in the height at withers and in chest circumference, and records of feed consumption. The total gain in weight from the initial day of the trial until the termination of the 4-weeks observation was the main criterion for measuring the effect of the treatments. Daily health observations were made on all the calves.

Results and Discussion

BODYWEIGHT GAINS

Experiment I

The effects of oral and parenteral administration of aureomycin upon the growth and feed consumption of the calves in Experiment I are summarized in Table I. The results indicate that 70 mg. of aureomycin administered daily was effective in increasing the bodyweight gain over that of controls from birth to four weeks of age. These findings are in agreement with previous studies at this Station. The calves receiving 70 mg. of aureomycin daily gained 32 percent more in bodyweight than the control calves during the 4-weeks period.

The oral administration of 250 mg. of aureomycin in a single weekly dose resulted in an average bodyweight gain during the 4-weeks period of 0.9 lb. more per calf than observed with the animals in the group receiving 70 mg.

The calves in Group C, which received 60 mg. of aureomycin weekly by implant, and the calves in Group E, which received the same amount by intramuscular injection, completed the experiment with lower average bodyweight gains than the controls.

TABLE I.—The Effect of Aureomycin Administered Orally and Parenterally Upon Growth and Feed Consumption of Dairy Calves During the First Four Weeks of Life.

(Experiment I)

Group*	Avg. initial weight (lbs.)	Average growth gains by 4 weeks in: Bodyweight (lbs.)	Height at withers (in.)	Chest circumference (in.)	Average feed consumed by 4 weeks (lbs.) Milk	Starter	Hay
A	73.4	11.4	1.4	1.4	164.9	8.3	4.8
B	73.0	15.9	1.6	1.9	165.4	5.9	5.2
C	76.6	10.9	.9	1.4	153.9	5.6	4.6
D	74.1	15.0	1.6	1.8	165.2	9.6	5.6
E	77.3	9.1	1.0	1.4	166.0	5.2	4.6

* Each group consisted of 4 Guernseys, 2 Ayrshires and 1 Holstein. Group A, control; B, 250 mg. aureomycin weekly by oral administration; C, 60 mg. implant weekly; D, 70 mg. daily by oral administration; and E, 60 mg. weekly by intramuscular injection.

TABLE II.—The Effect of Aureomycin Administered Orally and Parenterally Upon Growth and Feed Consumption of Dairy Calves During the First Four Weeks of Life.

(Experiment II)

Group*	Avg. initial weight (lbs.)	Average growth gains by 4 weeks in: Bodyweight (lbs.)	Height at withers (in.)	Chest circumference (in.)	Average feed consumed by 4 weeks (lbs.) Milk	Starter	Hay
A	78.0	8.4	1.4	1.0	167.7	6.6	7.7
D	76.4	16.8	1.0	1.5	173.6	13.6	8.1
F	76.8	14.0	2.1	1.3	170.0	9.2	6.8
G	74.4	12.8	1.6	1.3	171.4	8.7	6.8
H	74.4	11.6	1.5	1.2	166.9	9.1	10.1

* Each group consisted of five calves. Group A, control; D, 70 mg. aureomycin daily by oral administration; F, 500 mg. weekly by oral administration; G, 250 mg. weekly by intramuscular injection; H, 125 mg. weekly by oral administration.

Group C had a somewhat higher incidence of scours than the controls as well as a longer average duration of each case of scours, which might account in part for the lower bodyweight gains observed. The calves in Group E had an initial bodyweight of 3.9 lbs. more than the controls, which perhaps should be considered when comparing the terminal weights of these two groups; but it is not likely that this factor had a material effect upon subsequent gains.

No beneficial results were obtained from the subcutaneous implantation nor the intramuscular injection of 60 mg. of aureomycin under the conditions of this experiment. It was not possible to determine how much time was required for the aureomycin implants or injections to be absorbed into the blood stream. The rate of absorption may have been too slow to result in sufficiently high blood concentrations to be effective in stimulating growth. There is also the possibility that the level of antibiotic administered was too low to be of any benefit. If this last observation is correct, the low bodyweight gains made by Groups C and E might be caused by the added stress due to the mechanics of administration.

Experiment II

The data relative to the treatment effects in Experiment II are summarized in Table II. The average gain of calves receiving 70 mg. aureomycin daily was twice as great as that of the control calves.

While levels of 125 or 500 mg. in single weekly oral doses resulted in apparent growth responses, neither of these levels appeared to be as effective as 70 mg. administered daily. It appears that 500 mg. aureomycin orally may be too large an amount in a single dose for an optimum growth response since the administration of a similar amount, 490 mg. in daily doses of 70 mg., resulted in 20 percent more average weight gain per calf.

The calves in Group G receiving 250 mg. of aureomycin by weekly intramuscular injections gained an average of 4.4 lbs. more than the control animals. The gain of these calves was 76 percent as much as those receiving 70 mg. daily orally. It appears, therefore, that intramuscular injection is not as efficient as oral administration, since the oral administration of 250 mg. weekly in Experiment I resulted in weight gains equal to those in the group receiving 70 mg. daily.

CHANGES IN WITHERS AND CHEST SIZES

The gains in height at withers and chest circumference were small and inconsistent in all groups in each experiment. The calves in Ex-

periment I which received aureomycin by oral administration had slightly larger gains in height at withers and chest circumference than the other groups. With the exception of the 70 mg. daily group with respect to height at withers, there tended to be similar advantages for the aureomycin-treated calves in Experiment II. It is doubtful that these small changes were materially associated with experimental treatment in either trial.

FEED CONSUMPTION

The milk consumption by all groups was rather constant. Very little starter or hay was consumed by the calves in any of the groups. However, the calves receiving 70 mg. of aureomycin daily consumed somewhat more starter than other calves in both experiments.

SCOURS

Scours was not considered a problem of serious nature due to the low incidence and mildness in form of most cases. Although slightly less scouring was observed in those groups receiving oral administrations of aureomycin, it appeared that a major portion of the scouring was associated with errors in management and was not particularly related to experimental treatment. The latter observation was substantiated by the fact that during the course of this study there were two periods during which wet sawdust was inadvertently used to bed the calves. It was during these two periods that the most serious outbreaks of scours occurred.

Summary

Two experiments were conducted to determine the effects of different levels of crystalline aureomycin hydrochloride administered orally, subcutaneously and intramuscularly upon the growth rate, feed consumption and general health of dairy calves during the first four weeks of life.

The oral administration of 70 mg. aureomycin by capsule resulted in average bodyweight gains at four weeks which were 3.6 to 8.4 lbs. greater per calf than controls in Experiments I and II, respectively. In Experiment I, 250 mg. in a single weekly, oral dose was as effective in stimulating growth as 70 mg. administered daily. In the second experiment, 125 mg. and 500 mg. in single weekly, oral doses resulted in 3.2 and 5.6 lbs., respectively, more gain per calf than controls; but

this response was considerably less than the 8.4 lbs. weight advantage realized by the administration of 70 mg. daily in the same trial.

The intramuscular injection and subcutaneous implantation of 60 mg. aureomycin appeared to depress growth as compared to controls. When 250 mg. were injected intramuscularly, however, bodyweight gains were increased by 4.4 lbs. over controls as compared to an 8.4 lbs. increase by the daily oral administration of 70 mg. in the same trial.

Scours was not a problem and though there was some indication that the oral administration of aureomycin had a controlling effect, it is doubtful that any relationship existed between the incidence or severity of scours and growth benefits in this study.

Differences in certain body measurements and in feed consumption were small and were not related consistently to the experimental treatments.

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